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The Significance of Identifying Industrial clusters
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ABSTRACT

Industrial clustering policy is now an integral part of economic development planning in most advanced economies. However, there have been concerns in some quarters over the ability of an industrial cluster-based development strategy to deliver its promised economic benefits and this has been increasingly been blamed on the failure by governments to identify industrial clusters. In a study published in 2001, the DTI identified clusters across the UK based on the comparative scale and significance of industrial sectors. The study identified thirteen industrial clusters in Scotland. However the clusters identified are not a homogeneous set and they seem to vary in terms of their geographic concentration within Scotland. This paper examines the spatial distribution of industries within Scotland, thereby identifying more localised clusters. The study follows as closely as possible the DTI methodology which was used to identify such concentrations of economic activity with particular attention directed towards the thirteen clusters identified by the DTI. The paper concludes with some remarks of the general problem of identifying the existence of industrial clusters.

Keywords: Industrial Clusters, Scottish economy, Travel-to-work areas

JEL Classification: L23, R12

Introduction

In recent years, industrial clustering policy in Scotland has been, in part at least, directed towards supporting and fostering the development of industrial clusters (Scottish Executive, 2000, 2001a, 2001b; Scottish Enterprise, 1993). However such a policy relies to a great extent on being able to identify industrial clusters. There has been little systematic work that has tried to identify such activity using freely available data, an exception being the DTI in their study of industrial clusters in the UK (2001).

The paper examines the possibility of identifying industrial clusters that exist in parts of Scotland. The methodology chosen mirrors, to some extent at least, that adopted by the DTI. After describing that methodology we amend the procedure in order to identify clusters of economic activity at the spatial level of travel to work areas in Scotland. The clusters identified are compared to the set identified for Scotland as a whole by the DTI. Further inspection of the results of the exercise suggests that cluster activity may be restricted to the larger urban settlements. However the identification of clusters attempted here does not recognise all the properties of clusters that have been noted by previous authors in the field. In a later section of the paper we look at these properties and discuss to what extent our approach might be modified in order to incorporate these potential features of industrial clusters. A brief conclusion ends the paper.

The Mapping of Industrial Clusters

The method of identifying clusters of economic activity adopted by the DTI is best explained by means of the diagram given in Annex 2 of their report and reproduced in Figure 1 at the end of this paper.

The method starts by identifying “regional highs” defined in terms of employment in 5-digit SIC industries. The DTI classify industries as “highs” if (a) they have, in the region under consideration, a location quotient greater than 1.25 and (b) the industry accounts for at least 0.2% of the employment in the region. This procedure identifies the first set of industrial clusters for any region. To these

are added a further set of industries which are determined by reviewing those industries that fail either or both of the criteria. This stage involves consideration of results from interviews with key representatives and agencies in the regions and an investigation of the structure of industrial trading linkages revealed in that primary and further secondary research.

In this paper we report results based on an application of the first stage of this procedure only. At this stage we have yet to incorporate any survey elements into our methodology nor have we explored any clusters that may be formed on the basis of trading links. The analysis of this study was conducted using 1998 Travel-to-Work areas (TTWA). Arguably TTWAs are the most appropriate area units to use, as these reflect, as closely as possible, what might be considered as local economies. Scotland contains fifty-two TTWAs. The employment data for 2004 were used as these were the most recent Annual Employment Survey data available from the National Online Manpower Information System (NOMIS). After identifying the "high spots" for each TTWA in similar manner to the DTI, these were then grouped to form the basis of an industrial cluster. However, we do qualify the results of this exercise by looking at the distribution of the numbers of firms in the industrial sectors identified. Arguing that an industrial cluster can hardly be said to exist unless there are a sufficient number of small and medium sized firms to interact with each other some "high points" were excluded if they were industries in which few firms were located in the TTWA being considered.

Key Findings

The diagram below summarise the results of the mapping exercises carried out in the Scotland's 52 travel-to-work-areas (TTWA). The cluster mapping exercise identified a number of industrial clusters in 8 TTWA areas, namely Edinburgh, Glasgow, Dunfermline, Dundee, Aberdeen, Greenock, Motherwell and Lanark, and Brechin & Montrose. In these areas the exercise identified both well-established and relatively recent and growing industrial clusters. The Information and Communication Technology (Edinburgh and Glasgow), the Financial Industries (Edinburgh and Glasgow), and the Oil and Gas and the

Mechanical Engineering (Aberdeen) sectors are the leading industrial clusters in Scotland. Biotechnology (Edinburgh and Dundee), Media and Entertainment (Edinburgh and Glasgow) are still at the introduction of their life cycles. Strikingly the rural areas of the country do not have appear to have any well established industrial clusters at this level of spatial disaggregation. There have been claims that there are several industrial clusters in both the Highlands and Islands and the Border region (Highlands and Islands Enterprise, 1998). However they do not appear to figure prominently at the travel-to-work area level.

All of these clusters consist of both small and large firms with the former tending to dominate in most sectors. Dunfermline, Greenock, Motherwell & Lanark and Brechin & Montrose have relatively small scale industrial clusters which might be regarded as spin offs from the industrial clusters of the main cities. The industrial clusters identified following this methodology are shown in Table 1.

It should be noted that the list of industrial clusters identified here differs from the list identified in the DTI study. For Scotland as a whole the DTI identified a set of 13 industrial clusters. The differences being that the eight sectors Agriculture/ Food Processing, Chemicals, Civil Engineering / Construction, Knitwear, Shipbuilding, Tourism, Whisky and Wood / Paper products do not figure prominently for any individual travel-to-work area. This would appear to suggest that in identifying cluster activity in an economy the spatial scale at which the identification is made may be crucial to the set of clusters identified.

Features of Industrial Clusters

Both Perry (1999) and Ketels (2003) suggest that there was need to test an industrial cluster in order to justify its existence. Their concern was that without such ground rules then it was possible to claim clusters at liberty, something they felt would lead to disorientation of the perception of industrial clustering. Wolfe and Gertler (2004) also noted that in many pre-existing studies of industrial clusters there had been a tendency of treating *bona fide* and impostor industrial clusters as uniform. Genuine industrial clusters are clusters with properties mentioned below whilst impostor clusters lack the characteristics displayed by genuine clusters. An

examination of the literature suggests that a genuine cluster is likely to exhibit most if not all of the following nine characteristics:

1. **Spatial / geographical proximity** refers to firms located near to other firms engaged in the same business. This is indispensable in that it enables firms to foster social interaction and trust, given the nature of the information firms in a cluster share with different institutions (universities) and infrastructure (national research stations) especially in the cities. Firms in this situation are also allowed to learn, compare, compete as well as collaborate with others without any difficulties (Perry, 1999; Porter, 1998). In addition geographical proximity encourages local outsourcing, especially for advanced and specialised inputs that involve embedded technology, information and service content. Here size of a firm does not matter but what matters is the provision of sharing information that will enhance efficiency in production and marketing given that lots of firms all over the world are chasing few consumers. The need for firms to be sufficiently close in space allows any positive spill-overs and the sharing of common resources to occur and in the process bringing more business to the cluster and more positive results such as quality products and services through both cooperation and competition (Steiner, 1998). As the results given in the previous section illustrate the spatial scale at which one works is likely to affect ones conclusions.
2. **Innovation:** Innovation is the key driver of competitiveness and productivity, especially if it is geographically localised and clustered firms form part of the set of total actors engaged in innovation system. The linkages between suppliers, producers and customers are important for innovation and are the key characteristics of the most innovative firms (Simmie, 2004).
3. **Communication (Information spill-overs):** Communication refers to the operation of industrial clusters in its social and economic context such as chatting, gossiping, brainstorming, in-depth discussions and problem analysis. Thus communication in a cluster is improved through continuous interaction and information-sharing. This in turn eliminates some misunderstanding and suspicions that might have existed gradually. Step by step the cognitive

distance is also diminished through the emerging of 'code-books' which refers to shared language, ways of communication as well as understanding the information (Maskell and Lorenzen, 2004). The advantage here is the ability firms have for face to face meetings which can be called at short notice. At the same time it is also possible to have a greater frequency of meeting because time and money costs are less than if some people have to travel long distances. One might argue that there are e-mails and video conferencing these days thus there is no need to have face to face meetings but this is not the case as media was found not be a substitute for physical face-to-face meetings, co-presence and co-location of people and firms within the same industry or region (Cumbers and Mackinnon, 2004: Bathelt et al, 2004). Firms in an industrial cluster tend to develop similar language, technology attitudes and interpretative schemes which are shared by those who participate in it. This gives them an advantage against loner firms who will not be able to share knowledge leaving them at a disadvantage (Bathelt at al. 2004; Maskell and Lorenzen, 2004; Wolfe and Gertler, 2004; Grabher, 2002a).

4. **Trust:** Firms with high-trust business networks benefit from the reciprocal exchange of information and knowledge but at the same time are bound by 'strong ties' of obligation which regulate behaviour and prevent 'malfeasance'. In this way, trust is conceptualised as a key form of 'glue' which binds networks together and sustains firms' involvement in the process of collective learning (MacKinnon et al, 2002; Wolfe and Gertler, 2004; Turok 2003).
5. **Critical Mass:** In industrial clusters, there is need to have a sufficient number of participants present in a cluster for the interactions to have a meaningful impact on firms' performance. The larger the number of similar and related firms in a spatial cluster, the more vibrant and valuable the local buzz; the more firms, the greater the potential for well-developed global pipelines; the better developed these pipelines; the more refined the buzz (Bathelt et al, 2004). Our incorporation of information regarding the size distribution of the firms in our regional "high spots" is one way of trying to incorporate this dimension of cluster activity.
6. **Linkages / Interactions:** Firms in industrial clusters need, to some extent at

least, to share a common goal. The firms can only benefit from proximity and interaction through social and economic linkages. Linked companies and institutions represent a robust organizational form that offers advantages in efficiency, effectiveness and flexibility. A host of linkages among cluster members results in a whole greater than the sum of its parts (McCann and Dewhurst, 1998; Porter, 1998; 2003; Simmie, 2004). In future research we shall try to reflect this feature of clusters by incorporating evidence on industrial trade patterns which may be found in the Scottish input-output tables.

7. **Social Embeddedness:** The strength of relationships in industrial clusters is described as the level of 'embeddedness' of the social network. All economic relations are socially embedded in the sense that these depend upon norms, institutions and sets of assumptions shared among a group of actors and are not in themselves, simply the outcome of economic decisions. Firms in a cluster have to work closely together to build confidence and trust in the cluster. This is possible if they work with one culture, norm and code of conduct as this will help them to cooperate and compete without affecting their business relationships (Gordon and McCann, 2000).
8. **Sectoral Specialisation:** There are significant economic advantages associated with firm specialisation and the deepening social division of labour. There is no doubt that specialisation enhances speed and responsiveness because it allows for greater focus and flexibility. Small entrepreneurial firms that characterise such a system of specialization are typically able to respond faster and more flexibly than larger companies who are constrained by wider vested interests. The advantages of speed and flexibility are particularly essential in a volatile, uncertain environment like that of IT industry. Specialisation is significant to the industrial cluster in that it is part of the so called 'external economies of scale' which refers to the advantages of scale created not by the firm, but by the industry. Thus a large-scale industry may enjoy the benefits of greater specialisation as well as a more efficient infrastructure, industry specific education and training, government and university research inputs. This is essential in that it reduces costs for all firms in the industry, large and small firms alike (McCann and Dewhurst, 1998; McCann, 2001; Parr, 2002).

9. **Cooperation and Competition:** Cooperation is the back-borne of an industrial cluster despite the presence of competition among the firms in a cluster. Firms in an industrial cluster can cooperate in seeking to get new work and may bid together on large projects. At times they may form consortia to access cheaper finance from both public and private money lenders. They may also jointly purchase materials and conduct or commission joint research but may compete as well (Newlands, 2003). Competition is dynamic and rests on innovation and the search for strategic differences. Knowledge in industrial clusters is created through increased competition and intensified rivalry (Porter, 1998 and 2003). The claim here is that rivalry between similar firms in an industrial cluster will be more intense, emotional and this creates a pressure for innovativeness in order to outsmart the local rivals (Malberg and Power, 2003). The argument here is that firms in a spatial proximity are more visible to each other and thus have the opportunity to observe, monitor and benchmark what their neighbours are doing thereby make them aware of the market trend at this enables them to react to market needs without paying for the information. It is free, easier and efficient of market researching. This also enables the firms with nearby rivals to be more innovative as they are able to see what they neighbours are doing than firms whose competitors are located elsewhere. The good thing about competition is that it increases innovation as well as productivity. It also promotes and stimulates the formation of new businesses which expands and strengthens the cluster itself (Simmie, 2004).

It is clear from the above list that there are many properties of clusters that we are not using to help identify industrial clusters within Scotland. To some extent therefore we may be guilty of identifying too many sectors as clusters. In some cases (for example Linkages) we hope to incorporate such a dimension in future research, however for many it would seem impossible to incorporate them fully into the identification process without trustworthy primary survey data.

Conclusion

In this paper we have used the DTI methodology to attempt to identify industrial clusters at a travel-to-work area level within Scotland. Comparing our results with those obtained by the DTI suggests that the level of spatial disaggregation chosen appears to affect the results of the exercise. At the national level rather more clusters of activity are identified. In future work we would hope to examine what happens to the methodology at intermediate levels of spatial disaggregation. Further, examination of the relevant literature indicates that there are a number of possible properties of genuine industrial clusters that are not utilised in the DTI methodology. Whilst admitting that the incorporation of all of these aspects might be impossible in future it is hoped to incorporate some of them.

The study mainly suggests that industrial clusters have a high-tech centred philosophy and tend to concentrate in urban areas rather than rural areas and therefore Scotland should seek to ensure that the identified industrial clusters are well nurtured in order to improve its competitiveness. The unfortunate thing is that the concentration of high technology industrial clusters, in the larger settlements such as Edinburgh, Glasgow and Aberdeen, will make it difficult for Scottish Executive to correct the long term employment decline in rural areas such as Highlands and Islands.

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Figure 1: Methodology Flow Chart; adapted from DTI (2001).

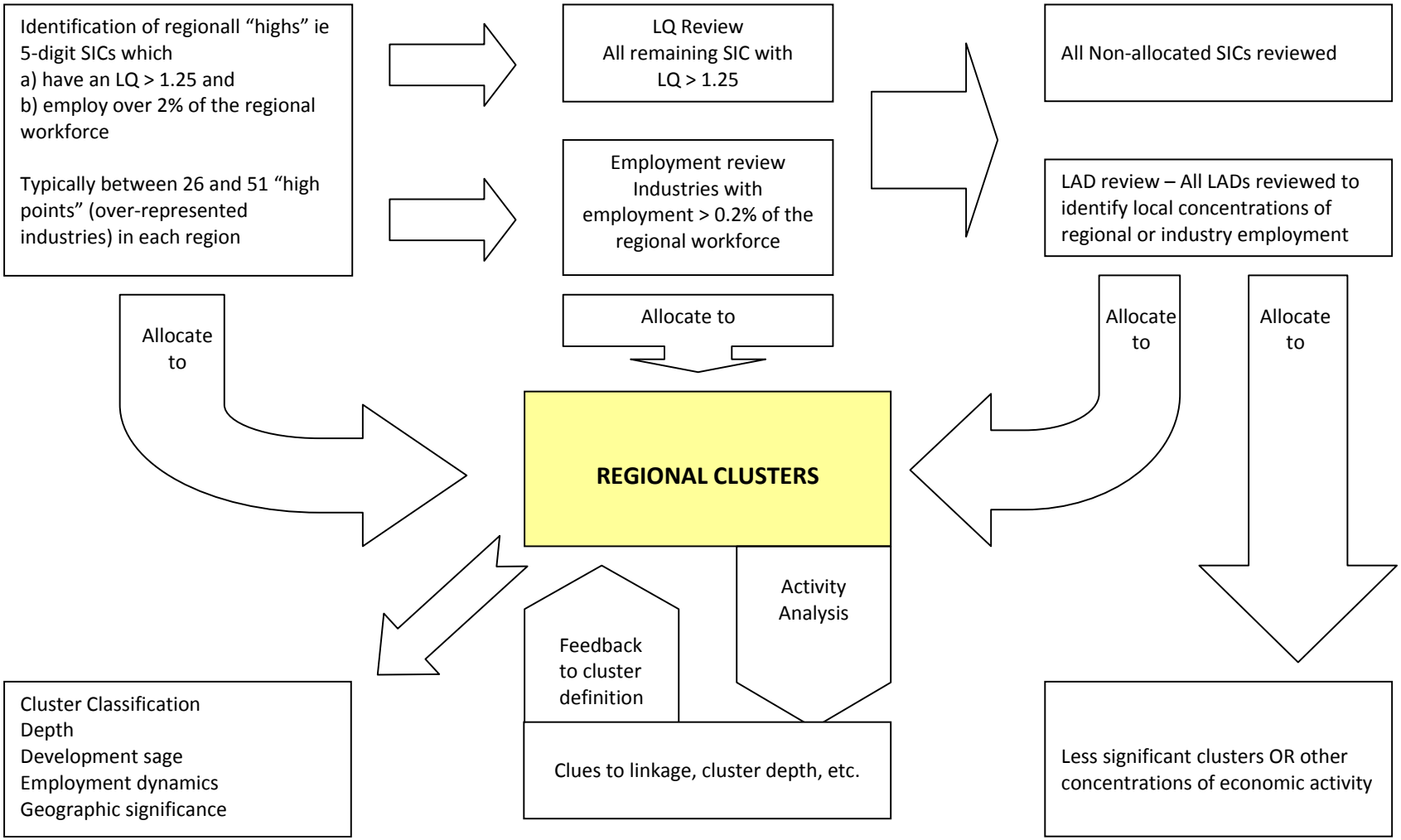

Table 1: Industrial Clusters in Scotland

TTWA	SIC CODES	INDUSTRIAL CLUSTERS	INDUSTRIAL CLUSTERS IDENTIFIED
EDINBURGH	3002 3210 3320 6512 6522 6523 6601 6712 7310 7320 9213 9220 9232 9234	• Manufacture of computers and other information processing • Manufacture of electronic valves and tubes and other • Manufacture of instruments and appliances for measuring • Other monetary intermediation • Other credit granting • Other financial intermediation not elsewhere classified • Life insurance • Security broking and fund management • Research and experimental development on natural science • Research and experimental development on social science • Motion picture projection • Radio and television activities • Operation of arts facilities • Other entertainment activities	1. Information and Communication (ICT) sector 2. Financial sector 3. Biotechnology sector 4. Creative sector
DUNFERMLINE	6512	• Other monetary intermediation	2A. Financial sector
MOTHERWELL AND LANARK	6512 6522 6720	• Other monetary intermediation • Other credit granting • Activities auxiliary to insurance and pension funding	2B. Financial sector
GLASGOW	3002 3210 3230	• Manufacture of computers and other information processing • Manufacture of electronic valves and tubes and other • Manufacture of television and radio receivers, sound • Non-life insurance • Activities auxiliary to insurance	5. Information and Communication (ICT) Sector 6. Creative sector 7. Financial sector
GREENOCK	7222	• Other software consultancy and supply	5A. Information and Communication (ICT) Sector
ABERDEEN	1110 1120 7420 7430	• Extraction of crude petroleum and natural gas • Service activities incidental to oil and gas extraction • Architectural and engineering activities and related tech • Technical testing and analysis	8. Oil and Gas sector 9.Nanotechnology (Mechanical engineering) sector
BRECHIN AND MONTROSE	7420	• Architectural and engineering activities and related tech	9A.Nanotechnology (Mechanical engineering) sector
DUNDEE	7310 7320	• Research and experimental development on natural science • Research and experimental development on social science	10. Biotechnology sector